Collaboration reasoning or social heuristics? Value proposition validity in *omnium-gatherum* business models

For

Special Issue on Innovation, Knowledge, Judgment and Decision-making in Virtuous Cycle

JBR

Chester K.M. To, Hong Kong Polytechnic University
Rachel W.Y. Yee, Hong Kong Polytechnic University
P. K. Mok, Hong Kong Polytechnic University
Desmond K.P. Chau, Hong Kong Polytechnic University
Carrie Wong, Hong Kong Polytechnic University
N. M. Cheung, Hong Kong Polytechnic University

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Abstract

Central to the value co-creation business model is mutualistic interaction, through which business value producers propose offers and affirm the final meaning of offering values with customer experience. The model treats each upstream offering of value production merely as a part of value proposition (Grönroos, 2011; Vargo, 2008). Thus, the interaction becomes a locus, key source of value co-creation (Echeverri & Skalen, 2011). Contemporary literature on interactive marketing and service research contain a myriad of theories clarifying the relevance and prominence of the interaction. However, there are still limited discussions regarding how business actors may propose a new potential value, and how the actors can judge the validity of the value co-creation in multi-actor business environments. This study provides a literature review on two main judgment paradigms used as a means to validate new value proposition and co-creation. The two paradigms are as follows: (1) collaborative rationality that evaluates rationales behind business actors' interactions for value co-creation; (2) social heuristics that concerns group-based satisficing decisions and judgments on a specific value proposition. Social heuristics use social information that does not necessarily stem from a formal, accurate analysis. To corroborate the theoretical implications of the two paradigms, the study analyzes a set of field case value validation processes for a novel product life cycle management information platform. The case study findings illustrate implications for collaborative business modeling and verification on new service-dominant value creation. Finally, the case study presents a prescriptive framework for smarter multi-actor value propositions and co-creation procedures.

1. Background

In service-dominant logic perspectives of marketing management, a value provider is not deemed to have fulfilled the value it is offering to customers until the customers are able to substantively use and experience the value. As such, marketing managers in organizations are shifting their attention from product variety to experience variety (Prahalad & Ramaswamy, 2004). The actual value that a customer receives is situationally driven and is subject to how the customer gets involved in exploiting the value offered. This concept reflects an epistemological belief in value co-creation. Organizations team up with collaborating actors to develop value concepts and value co-production processes. The contributions of the collaborating actors may be service or knowledge driven, and may emphasize new experience co-creation instead of merely product-centric marketing activities. This is especially true in today's networked economies, in which organizations cannot hold or systematically internalize all value proposition competences or knowledge (Granovetter, 1985). Collaboration among business actors and customers usually involves complex interaction processes. To master such interactive processes, management must comprehend new opportunities for value co-creation. Academics have created research agendas to understand the interaction preconditions, the mechanisms and the outcomes of such collaborative value creation. The contemporary research literature studying value proposition and co-creation is substantial. Normann and Ramirez (1994) explain the implications of interaction for consumer value creation. Vargo (2008) and Grönroos (2011) emphasize the service-dominant logic and challenge the product-centric marketing principles, as customers do not in reality seek product variety, but instead seek experience variety. Athaide and Zhang (2011) and Grönroos (2012) elucidate the concept of value proposition and value co-creation as a means of joint problem solving, rather than a way of targeting potential markets. Da Silveira (2011) examines a co-design business model, wherein value co-creation goes beyond the offering of customization and emphasizes individual users' experiences of personalization. All of these researchers' arguments have shared a common locus that emphasizes interaction as a means of creating feasible and valid value propositions and enabling co-creation.

This study leverages the principles of collaborative interaction to investigate opportunities for value propositions and co-creation. Regarding this issue, the arguments center around the

significance of value proposition validity, wherein actors judge the potential and appropriateness of a value proposition in collaboration with customers. The study argues that the collaborative rationalities involved can be used to judge the validity and potential of value propositions. This is a motivational perspective that takes into account collaborating actors' reasoning and behavior towards sharing knowledge, contributing efforts, setting common goals, etc. (Bacharach, et al., 2006; Gintis, 2016; Innes & Booher, 2010; Sugden, 2011).

In the decision-theoretic view of organizational heuristics, actors emphasize sets of rules or criteria, either on a sequential or a networked basis, to adaptively reach satisficing decisions. Such rules provide a fast-and-frugal means for replacing an all-faceted analytic evaluation of decision problems involved in assessing usability (Guercini, et al., 2015; Lai & Woodside, 2015). Separately, a stream of heuristics research has treated much of individual decision making and judgment as a cognitive process employing a fast and frugal response to stimuli. Such cognitive heuristics can also capture the effects of stimuli on social interaction. In addition to the collaborative rationality paradigm, this study adopts the social heuristics paradigm to examine the collective decision and judgment validity involved in value proposition processes. This social heuristics paradigm represents a context-dependent judgment perspective, wherein collaborating actors validate new value proposition potentials using sets of social heuristics involving social information to determine complex social interaction and business requirements. This is a prominent characteristic of heuristics for sociability (Gigerenzer & Gaissmaier, 2011; Hertwig & Herzog, 2009; Loock & Hinnen, 2015). This study examines the significant roles these two judgment paradigms play in today's service driven business models.

The paper is organized as follows. The next section presents a joint research-consultancy project case as the analytic subject of this study. The case concerns a novel information system platform and architecture for the product conception and commercialization process that purports to address the challenges of future industrial practice, i.e., Industry 4.0. Over an investigation period of six months, the project team invited a group of public officials, industrialists, technological specialists and engineers to review the new values of the platform. Through observation of this expert group's interactions and collaboration, this study attempts to explore anthropologically the theoretical premises for new business value judgments and the related managerial implications. The third section examines a set of theoretical propositions while

constructing prescriptively a reasoning framework for value co-creation and validation. A much-expanded literature review combined with dialectic scripting analyses expands the theoretic inquiry and induces the theory structure of the framework. Based on such premises, the study corroborates different strategies of collaboration rationalities and social heuristics applicable to the verification and judgment of innovative value.

The fourth section discusses the findings of the case study. Notably, this study affirms the complementarity between collaborative rationality and social heuristics in producing collaborative judgment. Considering the prescriptive framework, the case study proposes effective managerial guidelines for reaching collaborative judgment where value interests are diverse and uncertain. The last section concludes the findings and research limitation, and provides advice for future research with regard to value proposition and co-creation in open-access dynamic business ecosystem.

2. Research method

2.1. Case study

To understand the value validation process in new business model development, the study conducted a case analysis and in-depth interviews in a 2016 joint research-consultancy program. The effort helped validate the functions and potential of a new industry-specific product life cycle management (PLM) system. A PLM system is made up of computer-mediated product design and supply information systems. Standard PLM systems emphasize versatile, multi-module configurations to support creative teams engaged in all supply chain activities, from product design and development, sourcing and manufacturing to distribution/inventory controls. These PLMs are usually composed of a large bundle of prototyping, processing and business information modules, each acting as an integrated workstation. Most PLMs exchange data through middleware. They are also geographically dispersed, which means that the users cannot easily process distributed PLM tasks collaboratively on a real time basis. Significant to the novel system evaluated in this study is an initiative relating to collaborative platform-based PLM that allows users to propose jobs, submit feedback, and access other users' product ideas or end use alternatives. This novel PLM system represents an attempt to create a nimble platform that non-

professional users can utilize when conducting design and business tasks aimed at developing individualized social commerce (Yadav, et al., 2013).

The development of this platform has resulted in a private-collective innovative business model that is non-exclusive to any particular user group (von Hippel & von Krogh, 2003). The platform's users can attain private rewards by proposing new product concepts and new production methods and sources, and by opting for new supply business opportunities. This feature value serves *omnium-gatherum* users, i.e., individual users who can voluntarily assume most of the actor roles as customers, product designers, product planners, producers, and reviewers in nearly all kinds of business activities. The eventual platform will be a lightweight, open-access PLM intelligent platform. However, the platform's development sidesteps a number of critical questions, such as how the end users may perceive the value of this open-access social commerce platform, how a prospective user group can evolve into a sustainable platform community, and how the platform developers and users can maintain collaborative interaction without any clearly specified pre-commitments (von Krogh, et al., 2003).

In the course of developing and validating the PLM value potential, the program invited 16 industry practitioners as guest users to review all the PLM functions and performance features over a six-month period. The study invited 16 industrial users to act as study informants by providing data and information on their expectations based on the value co-creation business model and related experiences. The informants explained their validation approaches and corresponding judgments in assessing the values of the conceived platform-based PLM. To avoid receiving views and opinions that are too general in the responses, this study checked whether the informants had a sufficient understanding of the new PLM module structures, and then asked them to collectively judge the potential of individual module values. During the meetings, the informants' social interactions and behavior were recorded. Then, the study examined the observed interaction experience from the 16 guest users, three code/network specialists, and two program chiefs. Finally, the analysis of the record helped assert the nature and approaches that the practitioners rationalized the PLM platform value design and validity.

Table 1 highlights the PLM's core modules and values in this private-collective innovation, which form the basic framework for discussing and validating the platform-based PLM value components during the value co-creation process.

Table 1 here

2.2 Data analysis

In this case study, the research team analyzed three qualitative data sources: formal meeting minutes and narrative scripts on the project meetings, voice recordings, and individual in-depth interviews. The 16 industrialists, as the PLM platform's guest users and reviewers, along with two PLM research personnel and three technology consultants, provided more than 14,000 words of formal meeting minutes and 60,000 words in narrative script over a six-month period. The study also examined the informal discourse among the project participants as complementary analysis data. 720 minutes of voice recordings were transcribed into text codes. Apart from these data sources on the meetings, the study extended its data collection through face-to-face interviews. The interviews drew on semi-structured questionnaires and the information exploration approach. The interviewees were asked to explain and elaborate on the meanings of the points raised during the course of the interviews. Sixteen individual interviews were conducted, which provided the key information for final analyses. Table 2 provides data on the backgrounds of the informants (the 16 guest users of the novel PLM values, the two research project personnel and the three technology consultants), and indicates each informant's contribution regarding the three qualitative data sources (script contents, voice recordings, and interviews).

Table 2 here

The treatment of the script content and data analysis were conducted in the second half of 2016. The analytic process was interpretive: first, keywords and key concept points in the scripts and interviews were identified; then, these keywords and points were adopted as the data markers for eliciting the likely theoretical propositions and constructs; and finally, the relevance of these propositions and constructs for the validation of innovation values in the case was measured. The script contents were iteratively reasoned until the theoretic propositions were *interpretively* saturated, i.e., until the propositional constructs for judging and validating business value potential were evidently and consistently meaningful.

3. Theory induction

This section corroborates the propositions made and constructs a theoretical framework for value proposition and co-creation validation. The propositions are grounded on a mechanistic perspective of social group interaction (Elster, 1998; Storbacka et al., 2016; Sawyer, 2011). A mechanistic analysis begins by considering phenomenal interaction processes occurring at the lowest individual level. The description of such lower level processes should uphold and justify related phenomena at higher social levels at the end. Analyzing the mechanistic interaction takes place in two value creation contexts. First, in value aggregation, the actors call for new business values, and work with one another in non-mandatory fashion. They are expected to remain more *other-regarding* and pursue value refinement based on aggregated values. This is the nature of actor-actor interaction at the lowest level of value co-development. Second, values are transformed so that the new, emerging business values affect the entire value eco-system. A new value can roll out into the public sphere and *virally* evoke more value conception. This leads to a set of actor-situation interactions in which the actors aim at new value evolution to influence the public sphere.

Figure 1 illustrates the theoretical framework aimed at successful value co-creation in the two open business contexts. This is also a prescriptive framework, by which the management can judge the value potential and validity of the ideas. The judgments on value proposition and co-creation pass through two mechanistic social interaction processes, known respectively as value aggregation and value transformation. Validating the whole process of value co-creation should take into consideration the different group-based rationalities and heuristics involved in the two socio-mechanistic processes. The two reasoning paradigms enhance efficient interaction and communication in both the technical and social aspects. The following sub-sections clarify the factors involved in detail.

Figure 1 here

3.1 Rationalities in value proposition aggregation

A prominent feature of the platform-based PLM is user collaborative interaction aimed at sharing product ideas. Epistemologically, the interaction among actors can be seen as just a rational

means of validating the appropriateness of the final PLM architectural solutions. This view is linked to a notion of rationality that derives from prudent selection of the 'appropriate means' for achieving the desired end purposes. Therefore, validating the PLM's prospective values depends on the rational selection of performance data, criteria, and procedures as instrumental settings for evaluating alternative PLM architectures. The claim of rationality hinges on the objectivity exhibited while using the instrumental information (Sen, 1977). In practice, such instrumental rationality links to the deliberate arrangement of constructive dialogues to reach a consensus on the instrumental settings. These concepts are clarified by following statements from some system users:

> *The data are specified in different attributes and levels, and are associated with the routing of designs to different clients. I need to talk in detail with those who worry about the degree to which any parts are at risk. This costs time and energy, but is necessary. I know they cannot start their tasks without contacting me. [System Analyst # 1]*

> *There are many criteria for validating the (PLM) market value… More industry standard features and functions would confuse potential public users, but fewer functions would make it appear like a cell phone game app… They should be built according to relevant standards and concluded through agreement by all present at the meeting. I recommend a groupware account to keep the messages and record those we have approved and those we have rejected… that way, if we want to recall some information pertaining to the discussion, we can retrieve the threads quickly. [Guest user #11]*

> *Professionals always like to argue and debate. Agreement is not easy, though valuable. Communication makes us smarter through learning…at least it increases the chances of us accepting our differences and coming to a compromise. An essential way of achieving this is to be persuasive and logically meaningful. [PLM chief program manager]*

In practice, the rationality of a dialogist (a person who writes or takes part in a dialogue) focuses on facilitating dialogue and the sharing of views and opinions when the issues cannot be resolved simply through further participation (Coleman, 1986; Willson, 2001). Dialogist rationality spells out the intentions behind and the importance of the argument(s) through a deliberation of claims, an interpretation of concepts and knowledge, and the sharing of cases and issues, mainly on the basis of the actors' own principles and standpoints.

Proposition 1:

In collaborations where the views and opinion inputs are diverse, dialogist processes can converge the diversity into mutuality and consensus. Dialogist rationality frames new angles and new criteria to validate collective decisions and judgments.

In an exercise aimed at group rationality, the actors must accommodate the diverse judgments often found within groups and find ways to ensure that the corresponding collective interest and judgment of the members are respected in a manner acceptable to all actors. The actors must endorse the final collective judgment. List (2011) mentions a situation in which a group of highly cooperative actors still generate uncompromising and inconsistent judgment endorsements. In an instance observed in the present study, the majority of guest users believe that the platform-based PLM development can lead to greater value in product personalization. Through this platform, the sharing and delivery of product concept designs could be fast and efficient. Logically, the prospective users would enjoy the new value through exploration and co-creation. Central to the rationality challenge is the inconsistency of judgment loci chosen by the guest users when endorsing PLM values; these loci may be the personalization potential of the platform, the delivery of personalization leading to value co-creation, or the meaningful value of co-created experience to customers. The actors thus face the value judgment difficulty called *causes-means-ends intransitivity* (Lis, 2006).

Table 3 here

Table 3 illustrates a challenge associated with collective judgment endorsement. X, X→Y and Y reflect the three categories of judgment loci that can arise regarding the PLM: the value proposition of the platform's product design module, the platform's performance in delivering value co-production, and the customer's meaningful experience in value co-creation, respectively. If the judgment endorsement is based on the collective majority, the "$\sum X$" and "$\sum X \rightarrow Y$" are valid, but if the "$\sum Y$" endorses an invalid result, the collective rationalities are inconsistent and incompatible. The actors would then need to consent regarding which one of these three collective judgments should be the key locus for rational endorsement. Clearly, this phenomenon represents differing notions of collective rationality by endorsement. This phenomenon is clarified by the following statements from system users:

Guest user #2: The platform looks like the product design system currently in use at some university research in England. They call it a collaborative merchandising system that can engage customers already at an early stage of idea concept design and production planning. This is not about customization, but making personal experience clearer to customers. It sounds attractive. But I have doubts about whether customers really want it. Customers buy a design, but it doesn't mean they are going to design it on their own…

Guest user #11: I have doubts about some (PLM) module settings. Basically, all the modules work well and the inputs are friendly, but I cannot see the other's consensus. The engineering team likes to see some technology breakthroughs. Yet these breakthroughs may not be real in the minds of customers… We must conclude solutions by considering the capacities of the features (propositional values) or by their potential (co-created values) to satisfy our customers. The two ways are indeed not the same very often…

To further analyze the challenge against such endorsement rationality, the study requested the guest users to review and present validity judgments on all the core PLM module value potentials by using a yes-no dichotomous scale.

Table 4 here

Figure 2a, 1b here

Table 4 tabulates the guest users' judgment results in the three judgment categories: motive values, co-developed values and co-created values. In the motive values and co-developed values categories, the judgment results for all the core PLM functions follow a similar pattern and magnitude, but the results for co-created values are significantly different. Figures 1a, and 1b graphically illustrate the yes-no dichotomy results. The figures also present a visual explanation of the inconsistency and intransitivity of the summative judgments among value propositions, value co-development, and value co-creation.

Proposition 2:

In a collaboration process that determines the judgment endorsement via the collective majority, the loci of rationality can arise from reasoning based on value causes, means, or ends. The endorsement rationalities on the three causes-means-ends judgments can be

intransitive and incompatible. Actors rationalize their collective judgment on the basis of one or more.

Without the deliberation of these two dialogists and their associated endorsement rationalities, the collaborative innovation team cannot arrive at consistent judgments or endorse a mutually agreed upon solution.

Proposition 3:

Dialogist rationality builds on the sufficiency and appropriateness of actors' communication procedures for collective judgments. Endorsement rationality concludes the rational endorsement procedure for multi-actor judgment aggregation and convergence. These two rationalities complementarily support collaboration and consensus in the pursuit of value co-creation.

These propositions give prominence to the provisions of guidance and axioms for the group of actors to make consistent judgments, and take actions coherently and reliably. Dialogist rationality attempts to identify the best possible solutions through constructive communication, whereas endorsement rationality merely suggests procedures or instruments to confine multi-actor judgments into specific, but mutually acceptable, decisions. As evidenced in this study, the group rationalities manage to derive collective intelligence from social interaction and interdependence, as a manifestation of the wisdom of the crowd (To, 2016; von Krogh, et al., 2003).

3. 2 Heuristics in value proposition aggregation

Apart from cognitive information, this case study illustrates the impact of social information, that is, the heuristics used in social contexts, on the forming of judgments. Very often, actors begin by considering the salience and/or similarity of the other actors in the group and being aware of these actors' associated social information, such as their expertise, hands-on knowledge, attitudes, behavior, aims, personal dispositions and pre-commitment. Accordingly, actors draw a circle, sometimes unconsciously, in a *radius distance* of actor salience or similarity to pin down relevant, referential information. The circle of social salience/similarity is essentially situational and dynamically dependent on how many actors are in the circle and how long they stay there.

This is a group-based heuristic process, also known as a social-circle heuristic, or group heuristic in sociability, as discussed by Pachur, et al. (2005).

> *Guest user #13: Though I am a chief information officer, I won't jump to conclusions about these modules. But I would talk with the other guys. I believe Jake (Guest user #5) can share his view honestly. We got acquainted during our early careers. He had a team specializing even in 180" width lace and jacquard design. An ace team… … Well. In the last meeting, I found a guy who had also graduated from my college. We see eye to eye on the industry. We can be partners. (social-circle heuristic)*

> *Guest user #12: ….the Parts and Material Modules cannot pre-define Bills of Material items on my pad. This is a defect in my view. But I would not cast a "no" on it so quickly. I first consult with the others in my workgroup, since nearly all guys in my group are knowledgeable friends. We text each other…. (social-circle heuristic)*

As observed in the study, the social-circle heuristic establishes a trustworthy reference source for group actors to validate and infer consensual judgments. Such an inference is fast and frugal, owing to a handful of complementary heuristics: (1) An actor *imitates* judgment by the majority in groups. Imitation speeds up learning and consensus. Imitating-the-most-knowledgeable, -the-most-successful, and even -the-most-formidable can give group actors an opportunity to adapt to interaction environments responsively and evolve individual judgment capacity (Nikolaeva, 2014). (2) A social-circle defines the group actors' social proximity, collective interests and similarity preference, framing the *circle character* with norms and implied rules for the actors to follow. The group actors tend to follow default heuristics for collective judgment, so the chances of incongruity within the group are reduced (Guercini, et al., 2015; Sugden, 2011).

> *Guest user #5: In meetings, we are asked to conclude the progress of the project development. Very often we vote and endorse the approval on the module designs and functions. Frankly speaking, I often follow Ms. Graig (Guest user #13) to do it. She should be the most experienced in IT aspects, particularly with regard to CAD* (Computer Aided Design) *… … (Imitation heuristic)*

> *Code specialist #2: … … Luckily the guests don't argue much on it at the end, as Dr. Lee (Guest user #7) has made some good points. He is their grandfather. (Imitation heuristic)*

Guest user #1: I have some ideas about industry standards in software societies. We are now stuck in the evaluation of drawing tasks. We need to see the ASME [Y14.24M – engineering drawing types]; or GEIA-857/ ISO 10303 to check the common requirements for data management and interoperability….. simply refer all these to the industry standards…. ….The standards have already specified kinds of architecture and functions of routing, security and cryptography, network setting, metadata, client and client libraries, search, simulation tools, keys… Any discrepancies in a module against the industry compliance clauses would mean some wrong things we choose and give rise to a skeptical uncertainty to the other coupled modules? (default heuristic)

Proposition 4:

In an innovation context, social heuristics of social-circle, imitation, and default underpinning context-dependent procedures, rules, and governing standards are needed, apart from logics and analyses, to reach collective judgment to endorse value design and propositions.

3.3. Heuristics in value transformation

The literature on value co-creation has discussed its many facets, such as new perspectives of experiential value (Normann & Ramirez, 1994; Prahalad & Ramaswamy, 2004), collective intelligence (Boder, 2006; Mačiulienė & Skaržauskienė, 2016); wisdom of the crowd (Malone, et al., 2009); service dominant logic (Grönroos, 2011; Kohtamäki & Rajala, 2016; Vargo, 2008), actor engagement (Storbacka, et al., 2016), and the value co-creation process (Payne, et al., 2009). The associated theoretical and empirical deliberations have helped us better comprehend value co-creation emerging from actor interactions. Co-creation propels new cycles of value conceptions in public spheres, such as collective creativity, intellectual breakthroughs and societal level recognition (Ruef, 2000). As observed in the case study, there exist several heuristics that better support the validation of a value offering to public users.

Norton, et al. (2012) explain a non-rational cognitive process, also known as the Ikea effect, in which consumers' partial involvement in product creation gives rise to irregular judgments,

mistakes, and errors. However, focusing on judgment errors and irrationalities tends to overstate the role of heuristics as a bias, especially in cases of collective judgment (Jussim, et al., 2012). The Ikea effect provides evidence that the social heuristic is necessary to engage public users in value deliberation and co-creativity. Logically, the value created through experiential engagement can compromise the partial value deficiency of product per se.

In the PLM study case, the actors include the project team and the guest users who demonstrate a priori consensus regarding PLM investment concepts and functions in industrial standards. The 16 guest users were non-mandatory but believed that the ad hoc circle in question could validate the future forms and values of PLM. Additionally, the guest users were experienced practitioners in the industry. The users committed themselves to the participation rigorously throughout the entire validation exercise period. Although the actors had individual interests and contributed unique knowledge, they got along with one another with various degrees of involvement and pre-commitments. The group heuristic of pre-commitment provides a means to judge all the actors' efforts during the value validation process, as well as the outcomes of the process.

During meetings, the guest users voluntarily clustered themselves into 4 task groups to review and comment on the different function modules. The sub-group users drew on available peer networks and labor specialization for time and social management. When coming to conclusions in a meeting, all actor groups reach a consensus on the validation results more consistently and endorse the other groups' results with less queries. This comes with another social heuristic of social proof, a default, demonstrating good citizenship and mutuality (Hertwig & Herzog, 2009). The group actors in principle submit specific social references to the other users in the public communities. Such a mechanistic process of interaction gives a value transformation from a level of small size peer group to higher levels in industries and communities.

> *Code specialist #2: It's very smart. The library module can search and assimilate any on-line contents you can specify into your retrieval library cards. On one hand, it can put forth ideas; on the other hand, it sources ideas in using a media data adapter and RSS feed converter that sort natural languages and images. I think this approach can work together with a web crawler and crawl scheduler to do it. The platform is not an engine now, but rather a smart agent. Right? ... We give a name to it… (Ikea effect heuristics)*

Guest user #12: I don't know what will happen when a PLM becomes a social platform and users can propose designs and grab production orders at any time. It is likely that it is very disruptive and/or helps rebuild things we haven't seen before. People are likely to join in disregarding any results. People like taking part. Now crowdsourcing is quite similar. (Pre-commitment heuristics).

Guest user #4: Whatever happens, I accept it and vote for it; it is easy to use, especially in the apps and supplier management modules. All my sub-group gentlemen like it. A mobile app is very nimble and everyone finds it convenient and intimate. I would suggest it to my staff on a trial basis. My staff can spread the word about it. Hope more would join to increase the value. A belief in the digital world is that the more users there are in network media, the more activities and contacts we can see. The grouping power is far beyond what we can see…in case the majority of users choose it, they would not dump it as soon as they spot minor defects in it. This is an advantage. Roll it out… (Social proof heuristics)

Proposition 5:

In public sphere contexts, the actors value co-creation as a mechanistic interaction process to enroll more users for new value conceptions, and evoke new cycles of value transformation. The Ikea effect, which involves pre-commitment and social proof, provides three heuristics to validate the value of co-creation in platform-based omnium-gatherum business models.

As mentioned earlier, the central challenges to value proposition and co-creation in the two multi-actor business contexts arise from the collective reasoning strategies, on which the validation of new, innovative business values is based. Table 5 summarizes the value validation challenges arising in the two contexts, as associated with the antithetical propositional judgment strategies. Notably, the findings of the case study affirm that the complementarity of the two judgment paradigms, group rationalities and social heuristics, is the key requirement for collaboration management among business actors. Integrating these findings, the study develops a set of propositional theories along with the related guidelines to manage new business value creation and entrepreneurial contexts.

Table 5 here

4. Discussions

4.1 Implications for theoretical and managerial development

The study investigates the processes and outcomes of multi-actor interaction for value co-creation activities. In particular, the study examines how collaborating actors perform social interactions to reach collective judgments through group reasoning and a particular set of social heuristics. Based on the case observations and analysis, three positive aspects of business value validation by group rationality and group heuristics jointly are found to be significant.

First, group rationalities support judgment through a formal, objective evaluation of the means and the consequences. The means consist of deliberately planned procedures and methods leading to rational access of information with as much objectivity as possible for final decision-making. Objectivity cannot exist without constructive dialogues among interacting stakeholders. Dialogue-based rationality gives rise to the most prominent means to come to a consensus on complex judgments (Weber & Khademain, 2008). This is logical since, in most judgment situations, actors cannot easily discern what conditions, procedures and objective outcomes are considered rational criteria. In the case study presented, dialogist interaction rationalizes multi-actor understanding and arrives at collective judgments concerning the progress expected.

Second, during the course of case observation, the rationalities could not ensure that multi-actor judgment stays fast and effective. The diversity of the actors' views and interests forces the interaction to be *resilient*, i.e., information and proposals loop relentlessly among actors. Group heuristics can influence the means used to reach conclusions in a fast and frugal manner (Gigerenzer & Goldstein, 1966). Group-based, or social, heuristics set rules or guidelines for group actors as they reach judgments and make choices through social information exchange. In our case study, judgment heuristics ask for the wisdom of the crowd, which calls for distributed intelligence. Social heuristics underpin multi-actors' judgments.

Third, developing prospective business values for mass users is usually a complex mission. The value itself changes in pace with the growth of the user base and evolves dynamically at both the individual and social levels. The mechanistic thoughts involved characterize value creation in terms of two discrete social interaction processes, namely, value aggregation and value

transformation. Such a characterization of value creation can help administration and management to reach correct judgments for all possible value settings.

The case study has corroborated a prescriptive explanation and framework that is helpful to collaborating actors in the process of judging and assessing co-creation value validity (see Figure 1). The framework is constructed by a variety of group rationalities and heuristics to support the multi-actor value proposition process. This taxonomical examination of group and collective judgments contains additional implications for collaboration management of design group actor roles and interaction arrangements even in uncertain situations. The study has also corroborated the related principle of group (distributed) *effectivity*, in which committed, collaborative actors regard themselves effective when they feel that they have contributed to the groups' objectives by simply doing their own parts of duties, while having less information or concern about other actors' progress and performance (Colman, et al., 2008).

4.2 Future works

The study leads to a number of future research challenges and opportunities in value proposition and co-creation. First, in dynamic on-line social ecosystems, one often encounters a significant blurring of users' memberships or citizenships. There is therefore a need to find methods that help users autonomously identify their own roles and positions in unstructured work situations. Non-human intelligent agents may aid actors in exploring and assigning individual roles in open-access work platforms. This is particularly important when business models need to apportion collaboration rewards for individual users' contributions. Second, simply as a single sense, or measurement, of interaction may not effectively generalize the diverse modes and extents of actor participation. So far, as this study has observed, the actors' interactions and participation lead positively and non-competitively to participation effects. Still, there should be cases illustrating averse, or *co-opetitive* (simultaneously emphasizing cooperation and competition) effects of interaction in both private and public collaboration (Weber & Khademain, 2008; Willson, 2001). Interactions with other diverse interests in different forms, patterns, and levels of intensity can lead to different results in value co-creation business contexts. Third, the validity and potential of value co-creation is experiential-driven and contingent on different business contexts. Our case study consisted of observing a specific industry to enable theoretical induction. The findings and analysis would raise a question regarding research generality. Thus,

the study has also established a follow-up empirical research agenda to extend the corroboration in the future.

5. Conclusion

This study has investigated the processes involved in and the outcomes of multi-actor collaboration for value co-creation in product design and development activities. In particular, the study has examined how collaborating actors engage in social interactions and reach collective judgments through group-based reasoning and the chosen set of group heuristics. The study also contributes to the literature on multi-actor open business venture ecosystems, in which new business venture values emerge from unanticipated scales and cycles of interactions, i.e., the omnium-gatherum business model. Remarkably, these new values can be unprecedented, cutting across realms of business ecosystems. This is especially prominent in today's service-dominant technological innovation that aims to involve all types of business actors and users in the whole business eco-sphere. Our findings provide insights for business venture entrepreneurs to make collective judgments and come to consensus where value interests are diverse and uncertain.

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Table 1. A reference framework for constructing the core nimble PLM architectural values

#	Modules	Functional values	Desired novel values for *omnium-gatherum* actors
1	Central data vaults	The vaults should store and keep track of all the processing data and files bases.	Data contents are 'anywhere' assets. The capacity can be augmented by the scale and the growth of unrestricted user communities.
2	Design process and 3-D rendering	Develops and conducts the process design of visual objects. It processes 2-D and 3-D image conversion.	The development process involves collaborative work. Design concepts can be conceived, evolved, reaffirmed by multi-actors on the same cloud platform. All factors and decisions in the technical, creative, and consumer sides can be 'clouded' and 'presented'.
3	Parts and materials libraries	Develops and records raw materials databases; proposes types and sources of material availability and design concept alternatives.	The design and materials knowledge can be updated and evolved by the community's actors and PLM intelligent agents (e.g., media data adopter, Internet crawler, and crawler scheduler). Actors can learn about the product and process knowledge faster and more efficiently.
4	Project/collection management	Visualizes the collection concepts in simulated forms; schedules seasonal production and delivery; and stores operation requirements and timelines.	The scheduling and forecasting works are transparent and allow collective verification through the systems.
5	User access and security management	Defines and monitors the users and their access rights for system uses.	Actors can be grouped and clustered in accordance with the respective levels of participation and types of expertise contribution. Clustered actors result in knowledge specialization for the system's further development and evolution.
6	Business intelligence	Supports cost and business analyses and decisions in all phases of operations.	Clouded data and processing information are coordinated, allowing data analytics and decision support. Costs and resources are better allocated.
7	Technical pack – industrial standards and references	Records activity logbooks and advises on knowledge references to meet technical requirements and compliance with industrial standards.	Collaborative inputs allow compliance with diverse standards requirements in the relevant legal, consumer rights, safety and health, and ethics aspects.
8	Data exporter	Converts data and files to downstream activity tasks for further processing, e.g., ERPs (Enterprise Resource Planning systems) in inventory and sales forecasting and price setting; vendor management to control production and supply activities.	Actors can access and archive information through a better documentation and propagation process. The actors' work relationships can be promoted, or built, by the systems.
9	Development process administration	Allows users to customize the module's user-specific dashboard and interface system. Sets up system workflows and libraries.	Actors' experience can be learned and shared. The application of the system becomes more user-sensitive.
10	Apps	Provides on-the-go activities for mobile devices	The usability is nimble and 'intimate' to most of the groups and levels of practice within the community. Group user population can grow. Users shift their interaction behavior from an individualistic to a social mechanistic process.

Table 2. Anthropological scripting and interviewing samples

No	Samples			Background	Analyzing data sources		
	Industrialists/ Guest users	Platform Research Program Team	Technology Outsource specialists		Narrative contents in meeting minutes and questionnaire	Voice recording in group meeting	Individual in-depth interviewing
#1	Supply Chain Program Manager			Apparel Manufacturer	✓	✓	✓
#2	General Manager			Innerwear Manufacturer	✓	✓	✓
#3	Trade Union Representative			Textiles Manufacturing Association	✓	✓	
#4	Chief Store Buyer			Retail Chain Store	✓	✓	✓
#5	Project Manager			Project Manager, Knitting Mill	✓	✓	✓
#6	Senior Designer			Buying Office	✓	✓	✓
#7	Manager Director			Apparel and Textiles Corporate	✓	✓	✓
#8	Buyer			Footwear Manufacturer	✓	✓	✓
#9	Regional Merchandising Director			German Buying Office	✓	✓	
#10	Chief Associate			U.S. Trading Corporate	✓	✓	
#11	Managing Director			Trading Company	✓	✓	✓
#12	Chief Operating Officer			U.S. Buying Office	✓	✓	✓
#13	Creative Director			Retail Store	✓	✓	✓
#14	Manager			Wholesale and Retail Store	✓	✓	
#15	Project Manager			Management Consultancy	✓	✓	
#16	President			IT Company	✓	✓	✓
#17		Chief Prog. Manager		Director, Research Centre	✓	✓	✓
#18		Project Associate		Network System Analyst, Research Center	✓	✓	✓
#19			Chief Programmer	Code Specialist 1, IT Consultancy	✓		
#20			Sales Manager	Code Specialist 2, IT Consultancy	✓		✓
#21			App Designer	Web architect, IT Consultancy	✓		

Figure 1: Value proposition/co-creation validation process

Value aggregation

→ Dialogic rationality

P1

→ Endorsement rationality

P2

→ Group-based social heuristics

P4

Rationality of collaborative interests

P3

Successful pursuit of value co-creation in open-access business contexts

Value Proposition Championship in a non-structural, open environment

Value transformation
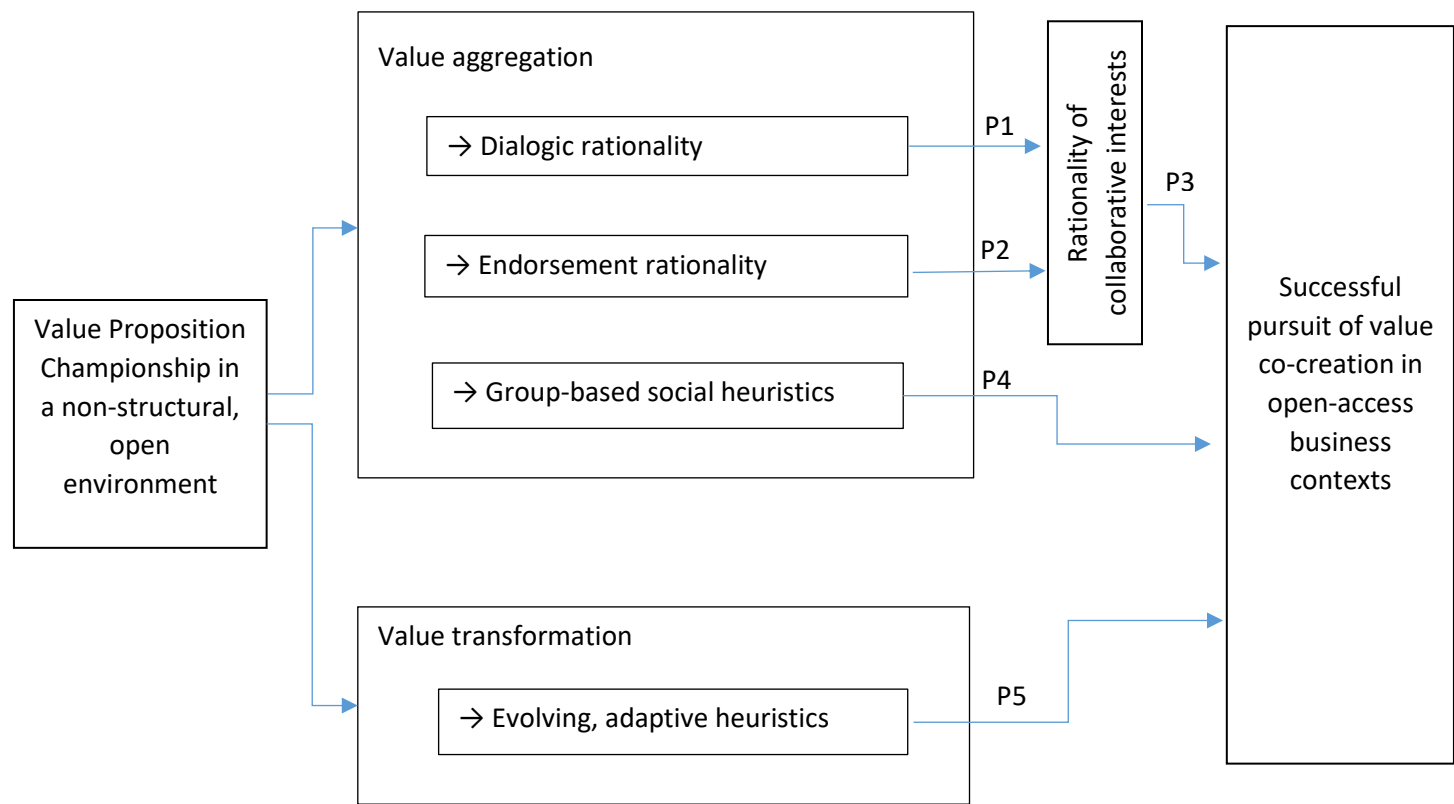
→ Evolving, adaptive heuristics

P5

Table 3: Illustration of a discursive dilemma in endorsing collective judgment

	Value proposition judgments on the CAD module	Actor 1	Actor 2	Actor 3		Actor 16	Majority
X	whether the PLM module, feature design and image rendering gives the motive function value, X	yes	yes	yes	… … …	no	14 yes
X→Y	whether the intended functional value leads to co-developed value, X → Y	yes	yes	no	… … …	yes	10 yes
Y	whether customers appreciate and affirm the experience, Y	yes	yes	no	… …	no	9 no

Table 4: Aggregated judgments on motive values, co-developed values, and co-created values

#	Modules, Xi	Validity judgment results from the 16 guest users								
		motive values, $\sum Xi$			co-developed values, $\sum Xi \rightarrow Yi$			Co-created value, $\sum Yi$		
		yes	no	neutral	yes	no	neutral	yes	no	neutral
1	Central data vaults	16	0	0	15	1	0	8	8	0
2	Design process and 3-D rendering	14	1	1	10	4	2	5	9	2
3	Parts and materials libraries	14	2	0	14	2	0	14	2	0
4	Project/collection management	9	2	5	8	3	5	3	8	5
5	User access and security management	16	0	0	14	2	0	10	6	0
6	Business intelligence	9	2	5	10	3	3	3	10	3
7	Technical pack – industrial standards and references	13	3	0	13	1	2	7	7	2
8	Data exporter	8	4	4	6	6	4	8	8	0
9	Development process administration	7	7	2	8	6	2	3	11	2
10	Apps	15	0	1	14	1	1	6	10	0
	average	12.1	2.1	1.8	11.2	2.9	1.9	6.7	7.9	1.4

Figure 2: Aggregated user judgments on the 10 key PLM modules

Figure 2a: Positive Judgments on X, X→Y, Y

Figure 2b: Negative judgments on X, X→Y, Y
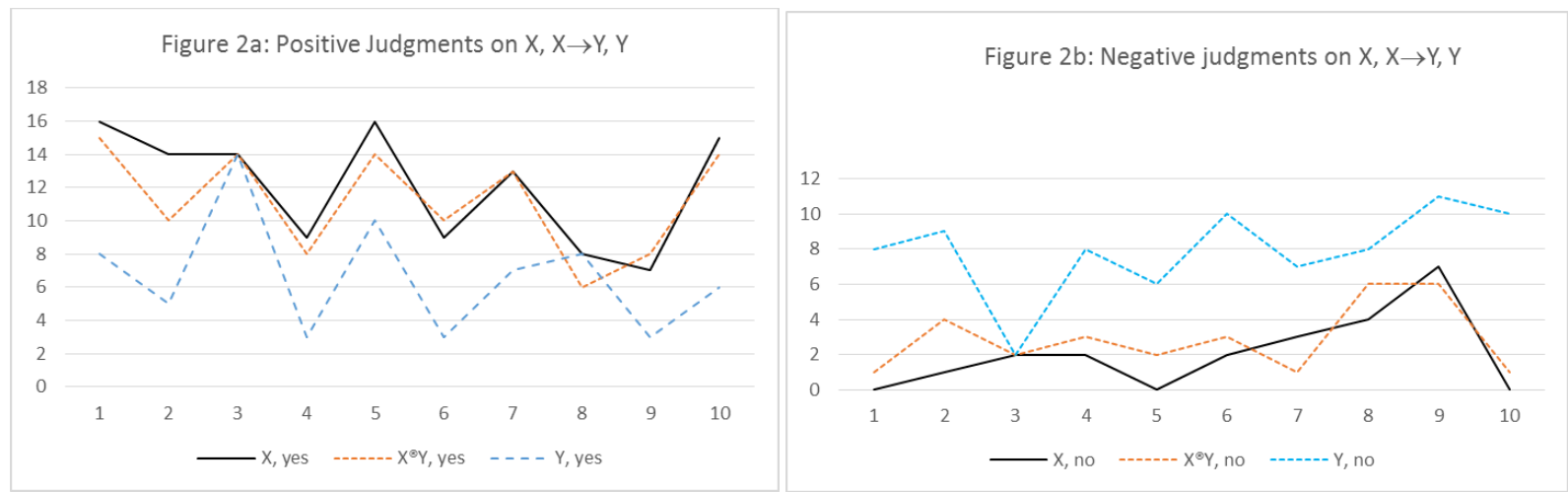
Remarks: The solid line indicates the aggregated judgment on the proposed values; the small dash line indicates co-produced values; and the long dash line indicates co-created values.

Table 5: Validating value proposition and co-creation: rationalities and heuristics that emerge in the two business value contexts.

Perspectives in social process systems		Challenges to the judgment and validity requirements	Validating judging value propositions
			* Actors are non-mandatory participants in the 'private-collective' collaboration. * Actors regard the collaboration as an 'intellective" task work environment (Mačiulienė & Skaržauskienė, 2016; von Hippel & von Krogh., 2003)
↓ Aggregating values	Actor ↔ Actor Interaction	Value validity challenges: 1. How well group members can communicate with each other through more perspective-taking, shared visions and engagement of common values. 2. How well a novel value can be emerged and lead to a consensus during the dialogic interaction process. 3. If Q is an anticipated, reformed value from the initial proposition P, can the reformed value be eventually accepted by market as a co-created market value? P → Q 4. A 'discursive dilemma', as coined by List (2011), happens in the situation in which group consensus can be based on Ps, or Ps→Qs, or Qs, but cannot be based on all three.	Prop. 1 - Dialogic rationality - Interactions among value actors are complex: ill-defined, ad hoc, and unrelenting (Sen, 1977; Storbacka, et al., 2016). - Group actors collaborate to extend rational bases to formulate alternative solutions and value capacity, i.e., distributed learning (social effectivity) (Coleman, 1986). - Dialogue-based interactions allow a disciplined communication process to establish a criterion framework or facilitation to address complex, difficult shared tasks. Management of the forms, patterns, and intensity of dialogues are the key determining factors (Willson, 2001). Prop. 2 – Endorsement rationality - Actors seek to affirm value proposition validity through reframing a new value proposition alternative from multiple experiences among interacting actors (List, 2011). - Actors judge collectively the existing value offers and new anticipated values. Existing value offers become reference points to estimate the likelihood of new refined value potential. Actors can focus on existing value performance or new value potential as a means for collective judgment, i.e., judgmental rationality (List, 2006; 2011). Prop. 3 – Collaborative rationality - The judgment subjects are group values, interest alignment and consensus methods (Colman, et al., 2008; To, 2016; von Krogh, et al., 2003).

			Prop. 4 - Group-based social heuristics *Group heuristics in sociability*: - Group actors use rules, evident cues to address unknown aspects of collaboration, and uncertain consequences of co-work commitment. - Actors also validate value propositions whether they are feasible or not, using organizational rules, implied conditions and default heuristics, which involve fast and frugal information deliberation and social learning: 1. Social-circle, -similarity (Pachur, et al., 2005) 2. Imitation, group learning (Nikolaeva, 2014) 3. Team-player Default (Guercini, et al., 2015; Sugden, 2011)
Transforming Value	Actor → Situation interaction	Value validity challenges: 1. How innovative group actors can perceive the value potential in whole practicing communities. 2. How far group actors extend the boundary of the network to influence more new actors.	Prop. 5 - Group-based social heuristics *Group heuristics in use* - Heuristics drive provider-customer interaction through rule-based mechanisms (Guercini, et al., 2015). - Interaction is outreaching, and promotes values to diverse groups of counterparties in the public, future potential customers, etc. (Lai & Woodside, 2015; Malone, et al., 2009). - Actors re-define and transcend the new core value toward upper value concept levels. The value focuses on the totality of customers' needs, such as social recognition, creativity, intellectual achievement, etc. (Gigerenzer & Gaissmaier, 2011). - Therefore, the actors' value co-creation is evolving, enabling the creation of more new value through more user participation. Social reference forms a heuristic to validate the co-created value potential (Boder, 2006; Mačiulienė & Skaržauskienė, 2016). - Heuristics adopted: 1. Ikea-effect for co-creativity (Norton, et al., 2012). 2. Pre-commitment (Hertwig & Herzog, 2009). 3. Social proof, social reference (Hertwig & Herzog, 2009).